DOCUMENT RESUME

ED 121 566 88 SE 019 333

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TITLE	Environmental Education Teacher's Guide, Junior High School. A Core Experience Study of the Natural Environment.
INSTITUTION	Maine Environmental Education Project, Yarmouth.
SPONS AGENCY	Bureau of Elementary and Secondary Education (DHEW/OE), Washington, D.C.
PUB DATE	75
NOTE	75p.; For related documents, see SE 019 332-335
AVAILABLE FROM	Maine Environmental Education Project, Intermediate School, Yarmouth, Maine 04096 (free)
EDRS PRICE	MF-$0.83 HC-$3.50 Plus Postage
DESCRIPTORS	Curriculum Guides; *Environment; *Environmental Education; Field Trips; Junior High Schools; Learning Activities; *Secondary Education; Skill Development; *Teaching Guides; *Water Resources
IDENTIFIERS	Elementary Secondary Education Act Title III; ESEA Title III

ABSTRACT

This Environmental Education Teacher's Guide, developed for use in the junior high school, is designed to familiarize teachers with how an environmental education program can help in their teaching and in achieving the goals of the school. The suggested core activities in this guide are designed to be a motivating way of introducting junior high school students to a practical understanding of the natural environment. The activities focus on those factors important in evaluating the stability of natural ecosystems and thereby identify areas sensitive to human development. The practicality of the unit is enhanced by the application of stability concepts in the content of a watershed. The activities have been devised to develop specific understandings, feelings and skills. Basic concepts, attitudes, objectives and skills are identified and a pre-post test is included to help the teacher assess educational outcomes. (BT)

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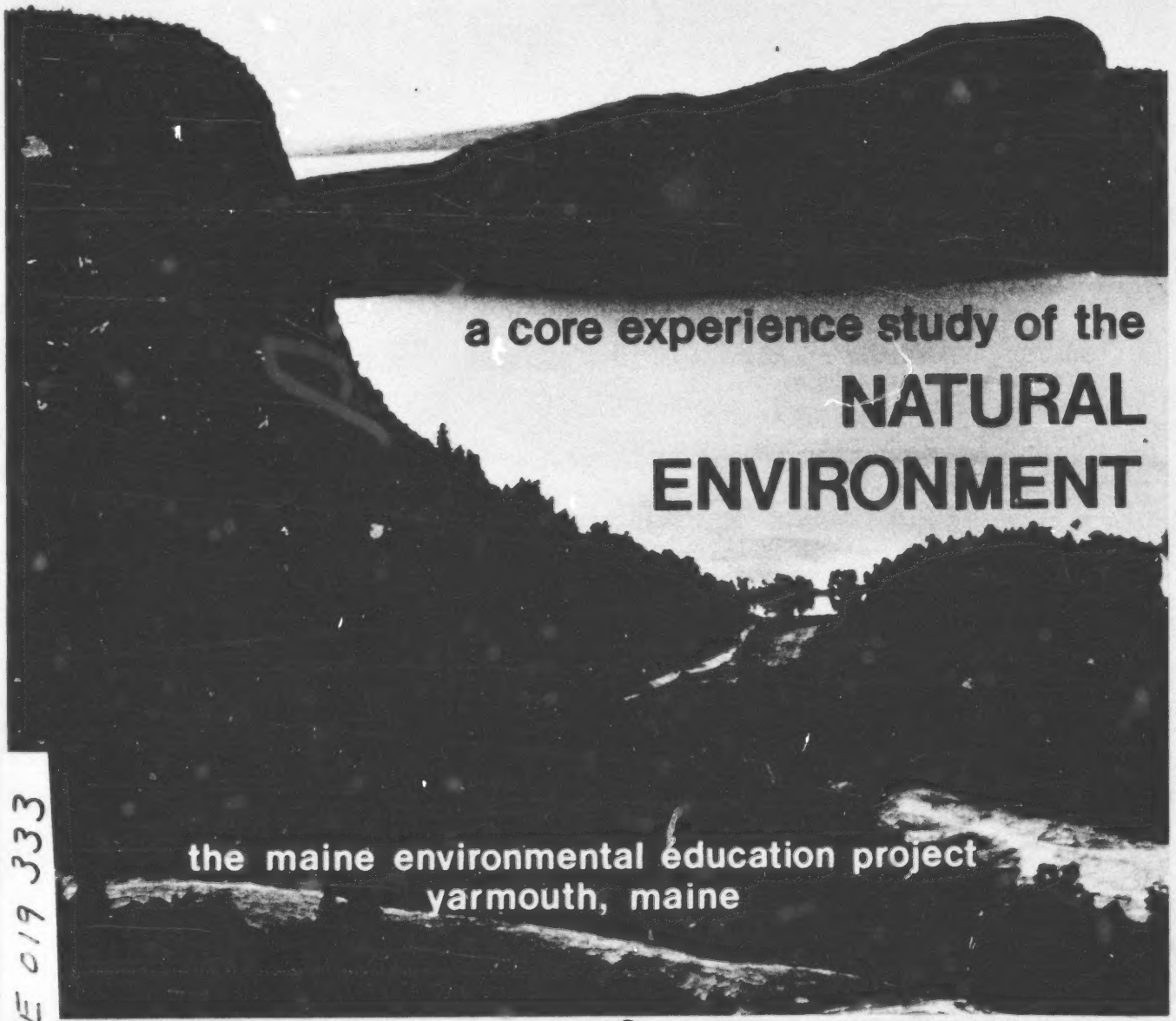
ENVIRONMENTAL EDUCATION

TEACHER'S GUIDE

JUNIOR HIGH SCHOOL



a core experience study of the

NATURAL ENVIRONMENT

the maine environmental education project
yarmouth, maine

SE 019 333

JUNIOR HIGH SCHOOL

ENVIRONMENTAL EDUCATION TEACHER'S GUIDE

THE NATURAL ENVIRONMENT

Prepared by:

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The Maine Environmental Education Project's
National Developer/Demonstration Program
E.S.E.A., Title III, 306

1975

Yarmouth, Maine School Department

This revision was performed pursuant to a grant from the U. S. Office of Education, Department of Health, Education and Welfare, under the Elementary-Secondary Education Act, Title III, Section 306. No official endorsement by the U. S. Office of Education should be inferred.

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To the Teacher:

This guide is designed to familiarize you specifically with how environmental education can help you in your instruction and in achieving the goals of the school.

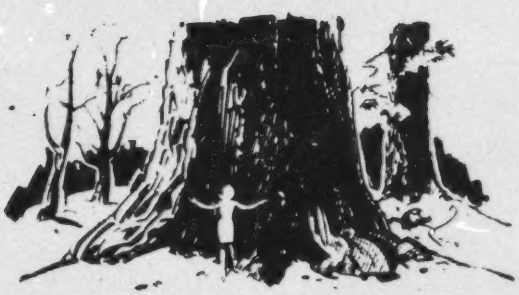
Environmental education aims at developing strong attitudes of concern for the quality of the natural and human environment and its role in meeting our needs - - attitudes which will lead to action to help prevent and resolve environmental problems.

The suggested core activities in this guide are designed to be a unique and motivating way of introducing junior high school students to a practical understanding of the natural environment. This means more than definitions and facts. In particular, it focuses on those factors important in evaluating the stability of natural ecosystems and thereby identifying areas sensitive to human development. In addition, the practicality of the unit is enhanced by the application of stability concepts in the context of a watershed. The watershed approach to environmental management is recognized today as an effective technique.

The activities have been devised to develop specific understandings, feelings and skills. They involve both classroom and field work. A pre and post test will enable the teacher to effectively assess the educational outcomes.

SECTION I

THE BIG IDEAS



THE BIG IDEAS

IN

ENVIRONMENTAL

EDUCATION

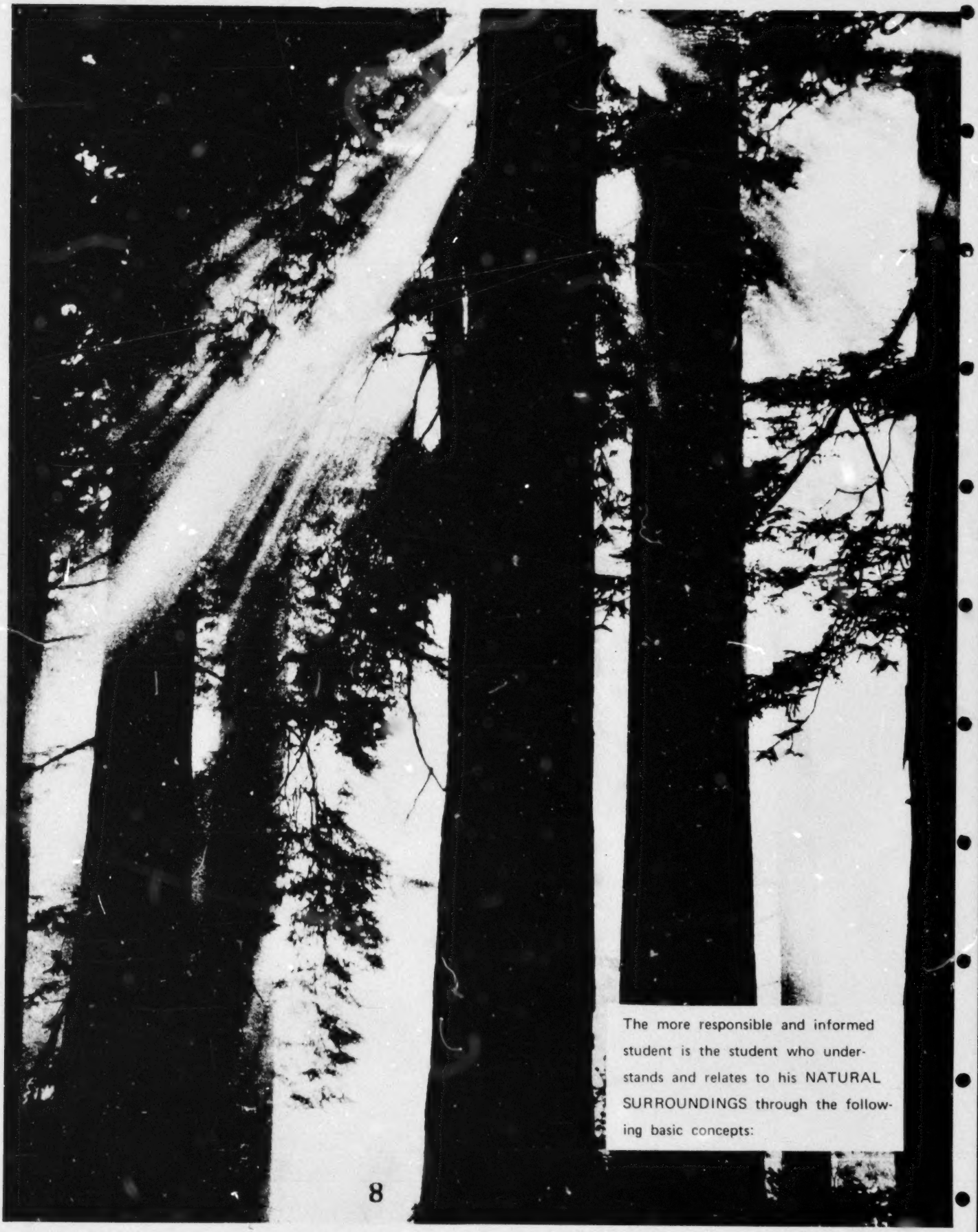
encompass

CONCEPTS

ATTITUDES

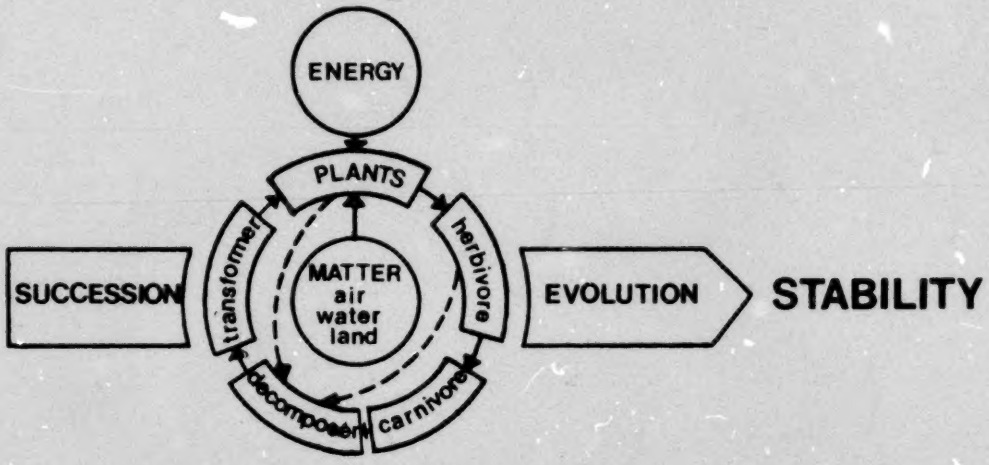
SKILLS

TEACHER ROLES



The more responsible and informed student is the student who understands and relates to his NATURAL SURROUNDINGS through the following basic concepts:

- The earth is a closed and finite system which functions as illustrated below:



- Each living and each non-living component of the environment has its own unique characteristics, its own unique relationships with other components, and its own pattern of change.

- The ability of a natural system to survive in a healthy state depends upon the amount of stability which it possesses. Stability depends upon:
  - a large number of different kinds of species present.
  - the kind and amount of food and matter present for consumption.
  - a large number of niches (roles) and habitats (places to live) for the species present.
  - the maximum cycling and re-cycling of matter.
  - the proper number of individuals present in the system.
  - the efficient use of energy.

Throughout this Teacher's Guide the following definitions of key terms will apply.

CONCEPTS

Concepts are abstract patterns derived from the inter-relationships of concrete facts. For example, trout eat mayflies is a fact; the food web of that pond is a concept. We believe that Environmental Education should aim to develop concepts in order that students be better able to understand the meaning of facts.

ATTITUDES

Attitudes are inclinations to view a concrete or an abstract object in terms of like or dislike, good or bad, right or wrong, etc. Attitudes are thought to consist of three essential parts or components. Two of these are feelings and understandings. If a student feels strongly enough toward the environment and its problems and possesses a sufficient amount of accurate information about it and how he can help resolve problems, his attitude may then contain a third component - a tendency or motivation to act.

It is believed that clusters of similar attitudes form a value.

SKILLS

The important skills in Environmental Education are those physical actions necessary to successfully carry out the process of discovery and investigation, evaluation and problem identification and problem solving.

The act of practicing these skills serves not only to allow a person to act on his values but also to contribute to a better quality environment.

■ Man has physical, psychological, and social needs which must be met by his physical surroundings.

Physical needs include an environment which is:

- useful and contains useful objects
- characterized by efficient objects
- safe and healthy
- lasting and has durable components

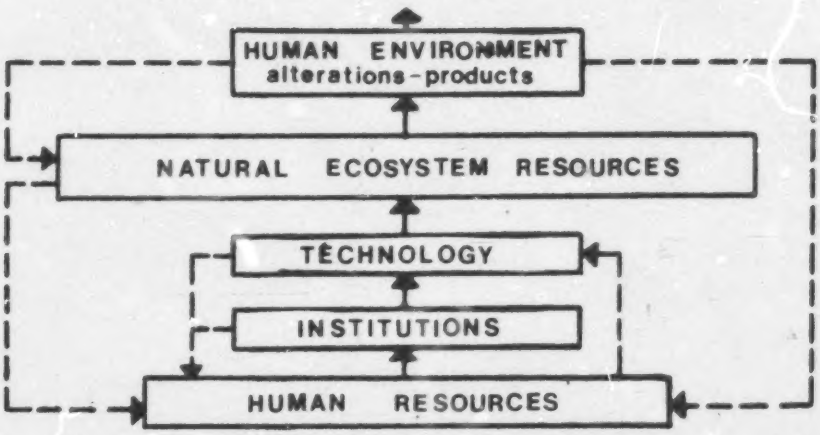
Psychological needs from our surroundings include:

- harmony
- stability and landmarks
- privacy
- variety
- areas for play and expression of aggression
- areas where one can learn
- personalized objects
- areas and things pleasant to look at and to be in

Social needs from our environment include:

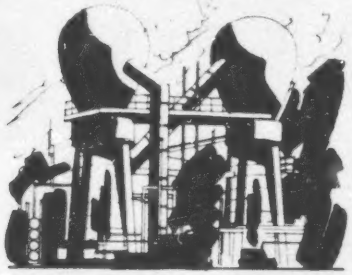
- places to gather and meet
- places to compete and challenge the elements
- places where one can express himself to others through speaking or the creation and display of objects

To fully appreciate why man changes his natural surroundings, how he does this, and the results of these activities of human culture the student should understand and relate to the following basic concepts regarding the MAN-MADE ENVIRONMENT:



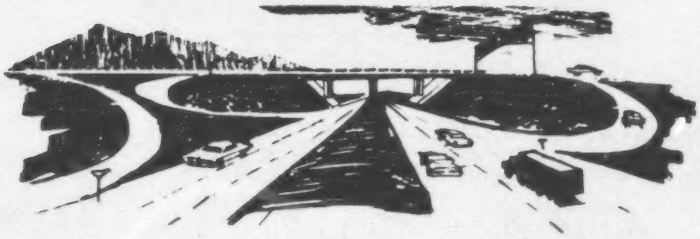
- It is ultimately the Natural Environment which must be utilized to meet these human needs and assorted human wants. To do this, man works through the institutional and technological systems upon the raw and refined resources. The results are the products and alterations characteristic of the Human Environment. The process and components of man/nature interactions are illustrated above.

■ The developed Human Environment and its products determine the extent to which the individual's needs and wants are met. Closer examination shows this Human Environment to consist of these general types of uses:



PRODUCTION

HUMAN SETTLEMENTS



TRANSPORTATION/CIRCULATION

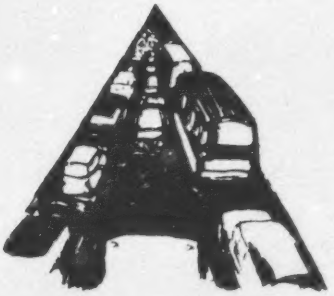
RECREATION

COMMUNITY SERVICES & UTILITIES

OPEN SPACE

■ However, this alteration of the Natural Environment to meet human needs and wants has a cost because the process is not totally efficient. Some of the more common spin-offs and undesirable side-effects are:

POLLUTION



CROWDING

WASTE

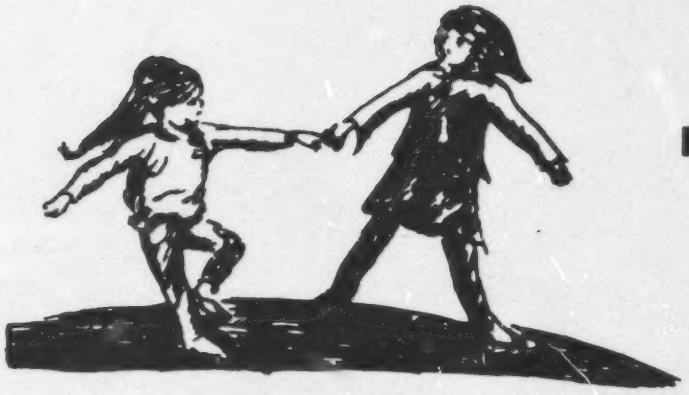
BLIGHT

Understanding these basic concepts of natural law, human intervention, and the results, both good and bad, of this intervention constitutes the factual basis of Environmental Education and lays the groundwork for personal value clarification and student activities.

Studies have shown that simply knowing the preceding concepts and facts alone does not imply that the student will have a greater appreciation and motivation or will have a tendency to work as an individual toward creating better quality surroundings.

To have this occur, the student must have coupled with the concepts and supportive facts the following feelings:

- A HEALTHY SELF-IMAGE



- A SENSE OF SOCIAL RESPONSIBILITY

- A SENSITIVITY TO THE ENVIRONMENT

- AN APPRECIATION OF LEARNING

The importance of both knowledge and feelings in determining the behavior exhibitied might be illustrated by the following:

Much Knowledge + Little Positive Feeling =
APATHETIC BEHAVIOR

Little Knowledge + High Positive Feeling =
EMOTIONAL BEHAVIOR

Much Knowledge + High Positive Feeling =
INTELLIGENT/EFFECTIVE
BEHAVIOR

No Knowledge + No Positive Feelings =
ALIVE?

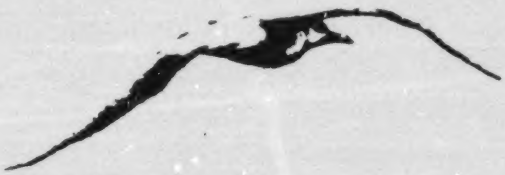
". . . only teachers who themselves are concerned about their environmental community will develop similar behavior in their students." *

* "What Kind of Environment Will Our Children Have?" published by the American Association of Colleges for Teacher Education, 1971.

Environmental Education presents to the teacher the opportunity to become an effective educator in the following three ways:

The FIRST ROLE of the teacher becomes one of helping students to DISCOVER their own environment. A teacher should set aside a part of the school year to go out into the community and on a first-hand basis learn about NATURAL ENVIRONMENTAL FEATURES such as:

- Geology
- Estuaries
- Floodplains
- Mammals
- Etc.



Investigations in the community which shed light on WHY the environment is changing relate to the human population and its characteristics such as:

- Migration patterns
- Government boundaries
- Housing
- Land ownership
- Historic Development
- Etc.

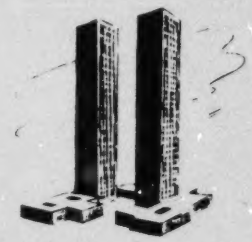
Investigations which show WHAT has happened to the natural ecosystem when man applies his culture can be found in Human Environmental Use Areas such as:

- Commercial locations
- Playgrounds
- Sewage treatment plants
- Energy production sites
- Industrial sites
- Public water supply
- Etc.

These investigations are rich additions in the existing curriculum and a complement to the standardized materials which cannot relate to each student's locale and situation. Environmental education must be indigenous education if it is to truly captivate the students interest and create motivation.

■ The SECOND ROLE of the teacher is to assist the students in EVALUATING the facts and information gathered in community-based research.

Students hear many conflicting ideas, theories and explanations about how the natural environment should be developed or preserved and how one human use in an area is more important than another. When investigating the local environment such feelings and attitudes are sure to arise. This cannot be avoided. But, there is a way to handle this.



All students should have opportunities to clarify and crystallize their own values. The teacher's role becomes one of:

- helping them to understand basic human and natural environmental needs, and
- assisting them to develop in their own minds the criteria by which to define quality surroundings.

It is important that balanced attitudes and values be encouraged. Tunnel vision, ill-founded prejudices, and obviously blatant disregarding of the facts should be discouraged.

The development of "mental yardsticks" by which to measure the quality of the environment results in the student's ability to identify opportunities for environmental maintenance and improvement. Without this ability to detect poor quality or to identify good quality in the environment based on carefully searched personal values, no person will consistently act and speak for the type of surroundings which he feels are needed.

A THIRD ROLE occurs for the teacher when the information generated and the values and attitudes explored lead to a high motivation on the part of the students to become actively involved. The teacher then can assist to facilitate PROBLEM SOLVING.

These problem-solving activities, properly managed by the teacher, can have significant returns in the form of increased understanding of concepts, acquisition of critical thinking, skills and clarification of attitudes and values.

There are many, many opportunities for problem-solving related to the student's environment. Problem-solving activities may take the form of:

1. Preventing something detrimental from occurring.
2. Correcting an existing detrimental condition.
3. Adding something which will enhance the function and quality of the environment.

In addition, the students may help resolve a selected problem or issue at one or two levels of involvement depending on the nature of the problem:

1. Communicating a suggested solution to others who might be in a better position to carry it out or whose support is needed. For example, giving a presentation, writing a letter, developing displays.
2. Actively carrying out a solution.
   For example, planting trees, monitoring an area to detect undesirable changes, developing a creative playground, etc.

Specific educational activities may be developed by both the students and teacher for each of the problem-solving steps listed below:

PROBLEM-SOLVING STEP	STUDENT/TEACHER ACTIVITIES	RESOURCE AIDS, ETC. NEEDED
1. Selecting a problem to resolve or improvement project to carry out.		
2. Inquring to become informed about the problem through investigation.		
3. Determining alternative solutions to the problem.		
4. Choosing the best solution after considering the consequences of each.		
5. Developing a plan of action.		
6. Implementing the plan of action.		
7. Evaluating the process and results.		

It is felt by many educators that the most educationally profitable step in the process above is number four - CHOOSING THE BEST SOLUTION AFTER CONSIDERING THE CONSEQUENCES OF EACH. This requires the exercising and development of thinking skills. In addition, choosing from alternatives is a process which helps the student clarify his feelings or values and opens up opportunities for a discussion of values. The clarification of values is seen as essential to helping people become consistent in their actions.

NOTE: Often issues and problems which students encounter have elements which may be controversial. The following guidelines for handling controversial issues are taken from the publication ENVIRONMENTAL EDUCATION PROGRAM, Toledo Public Schools, 1971, Compiled by William B. Stapp.

The classroom is the teacher's domain and it is imperative that the teacher use sound judgment and common sense in handling controversial issues. The following are guidelines to be considered in handling controversial issues in the classroom:

1. The classroom teacher must be aware of and take into account the (Regulations) of the Board of Education.

2. Encourage students to investigate environmental problems, but be cognizant and aware of their ramifications.

3. The teacher should know the times, the student body, and its cultural or sub-cultural make-up as they pertain to the issues at hand.

4. The teacher should assist pupils as a resource person to enable them to form intelligent and logical decisions.

5. The teacher should assist pupils in identifying the problems, collecting information, identifying alternative solutions, evaluating solutions, developing a plan of action, and working toward solutions.

6. The teacher shouldn't let personal feelings or prejudices be brought to bear upon the class. The students must be free to express themselves. However, upon request, it may be appropriate to make known views and rationale toward the end of the discussion period. The teacher should view his role as a resource person to assist students in seeking and clarifying different points of view.

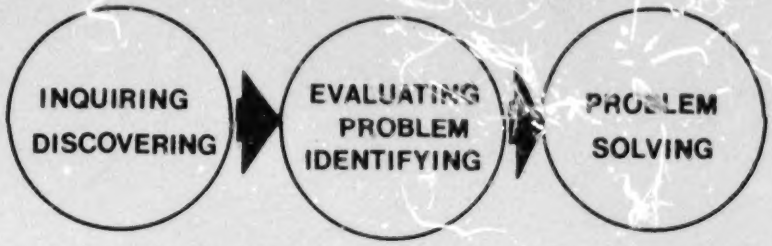
7. Strong emphasis should be placed upon the fact that a student may or may not agree with another's point of view but should respect that person's right to it.

8. Emphasize to the students the importance of considering all aspects of the argument before making decisions.

9. The teacher should strive to bring in several divergent views, references or resource persons.

10. The teacher should be sure that the issue is meaningful for the age group dealing with it.

Teachers who carry out these three roles of investigation, evaluation, and problem-solving have followed the process of Environmental Education as illustrated below:



The result of those environmental education experiences in which the teacher plays all three guiding roles and the students become personally and actively involved at all phases is the strengthening of the following skills:

1. Discovery/Inquiry related skills:
   a. Finding out what to investigate
   b. Gathering information on community environmental topics
   c. Compiling, recording, and reporting collected information

2. Evaluation/Problem Identification related skills:
   a. Formulating evaluative questions to use in judging the environment
   b. Finding answers to evaluative questions and comparing existing conditions to standards of quality

3. Problem-Solving related skills:
   a. Selecting a problem to resolve
   b. Inquiring to become informed about the problem
   c. Determining alternative solutions to the problem
   d. Making a decision (choosing) on the best solution after considering the consequences of each alternative
   e. Developing a plan of action to help resolve the problem
   f. Implementing the plan of action
   g. Evaluating the process and results

The next pages suggest a topic, format, and sequence for guiding two different types of Environmental Education experiences.

THE PROCESS OF

ENVIRONMENTAL EDUCATION

Natural Environment Example: Trees (plants)

Discovery - Inquiry	Evaluation - Problem Identification	Problem Solving
Classroom activities - Learn about the characteristics, interrelationships, changes, and uses of trees through lessons, books and publications, resource people, films, and other instructional aids.	Group or independent development of criteria to assess: 1) how well trees meet ecological needs, e.g., hold soil, prevent erosion, provide homes for wildlife, etc., and 2) how well trees meet human needs, e.g., physical needs, shade, etc.; social needs,, gathering places,; psychological needs, aesthetics, etc. Evaluate how well trees meet these needs in a real or hypothetical situation to identify environmental improvement opportunities.	Select a hypothetical problem, e.g., landscape a small park with trees. 1. Investigate the problem - needs, kinds of trees, etc. 2. Develop alternative solutions, plans for different plantings in a variety of locations. 3. Choose a solution after considering effects of each. 4. Develop plan of action - list steps and items needed. 5. Present plan for evaluation by others.
On-site activities - Investigate the trees on the school site and map and describe the kinds present on the site, their locations, sizes, condition, environmental effects, etc.	Develop evaluative criteria as above and assess extent present trees on the school site meet criteria. Identify: 1) existing conditions which need to be corrected - diseased trees, storm damaged trees, etc., 2) conditions which could be enhanced by planting trees, and 3) conditions threatening trees which should be prevented.	Select a tree problem to resolve on the school site; for example, white pine blister rust, etc. 1. Investigate causes, effects. 2. Develop alternative solutions. 3. Choose a solution. 4. Develop a plan of action. 5. Carry out plan. 6. Evaluate results.

THE PROCESS OF ENVIRONMENTAL EDUCATION

Man-Made Environment Example:

Walkways and Pathways (transportation-circulation areas)

Discovery - Inquiry	Evaluation - Problem Identification	Problem Solving
Classroom activities - Learn about the kinds, locations, functions, and characteristics of walkways and pathways through lessons, books and publications, resource people, films, and other instructional aids.	Individual and group development of criteria to assess: 1) effects of walkways and pathways on the natural ecosystem - altering drainage patterns, changing microclimate, removing vegetation, etc., and 2) how well walkways and pathways meet human needs: physical - safety, etc., psychological - aesthetics, etc., and social - bringing people together, etc. Evaluate walkways and pathways in a real or hypothetical landscape design plan.	Select a hypothetical problem, e.g., develop a plan for a new pathway. 1. Investigate the problem-needs, kinds of pathways, etc. 2. Develop alternative solutions - routes, kinds of pathways, etc. 3. Choose a solution after considering effects of each. 4. Develop plan of carrying out solution. 5. Present plan for evaluation by others.
On-site activities - Investigate walkways and pathways on the school site or in the community. Map and describe the kinds, locations, characteristics, conditions, and human and environmental effects.	Apply evaluative criteria as suggested above to walkways and pathways being assessed on site. Identify: 1) existing conditions which need to be corrected - erosion, potholes, rerouting, etc., 2) conditions which should be prevented - footwear erosion from overuse, encroachment of vegetation, etc., and 3) conditions which could be enhanced by creating new pathways, signs, etc.	Select a walkway or pathway problem to help resolve on the school site or in the community. 1. Investigate causes and effects. 2. Develop alternative solutions. 3. Choose a solution. 4. Develop a plan of action. 5. Carry out plan. 6. Evaluate results.

SECTION II

CORE ACTIVITIES

ENVIRONMENTAL EDUCATION CORE EXPERIENCES

The following experiences can be integrated into the existing junior high curriculum as a core which touches upon major concepts, feelings and skills which may be developed in the study of natural systems. They will probably suggest additional enrichment activities which would expand beyond what the standardized curriculum is able to offer. They are not in any way to be viewed as inclusive. Rather, they are intended to be examples of the different types of techniques and emphases offered by environmental education.

It should be noticed that these core experiences are multidisciplinary and challenge the student to identify socially and environmentally significant content which orients itself around the problems of everyday living.

It is to be hoped that in the study of topics and issues dealing with watershed management that the student will learn to weigh and balance evidence and be prepared to cope in his own way with these problems.

II -1/II-2

OBJECTIVES OF THE ACTIVITIES

Knowledge Objectives (Cognitive)

(Test item 1) 1. The student will be able to select the best definition of the term stability.

(Test item 2) 2. The student will be able to identify from a list the following seven indicators of stability:
- -species diversity
- -kind and amount of food and matter present
- -large number of niches
- -variety of habitats
- -efficient use of energy
- -proper number of individuals
- -maximum cycling and recycling of matter.

(Test items 3-5) 3. The student will be able to select the best definition of the following terms: watershed, divide, topographic lines.

(Test item 6) 4. The student will be able to identify and define seven factors which contribute to determining the stability of a watershed natural ecosystem.

(Test item 7) 5. The student will be able to select from a list of several natural ecosystems the one likely to be most stable.

Values Objectives (Affective)

(Test item 8) 1. Given information concerning a watershed, the student will exhibit a sensitivity to the natural environment through decisions on the placement of developments.

Skill Objectives

Investigation

(Test item 10) 1. The student will be able to identify the natural characteristics which lead to the rating of a stability factor.

Evaluation - Problem Identification

(Test item 11) 2. The student will be able to evaluate or rate three stability factors, code them and identify a potential problem site.

Problem-Solving

(Test item 9) 3. The student will be able to select and properly arrange a series of problem-solving steps relating to a natural ecosystem stability problem.

INSTRUCTIONAL MATERIALS

- Pretest and post test instruments
- Slide set - Natural Ecosystem Stability Concepts
- Slide set - Introduction to the Watershed
- Student worksheets - Watershed Identification
- Transparency of Little Concord Stream Watershed
- Transparency of Overview of Natural Communities in the Little Concord Stream Watershed
- Transparencies (7) - Natural Ecosystem Stability Factors
- Student Data Sheets - Natural Ecosystem Field Evaluation
- Transparencies - Natural Ecosystem Field Evaluation Data Graphs

CORE ACTIVITY NUMBER ONE

NATURAL ECOSYSTEM STABILITY

The purpose of this slide show and script is to introduce the students to the concept of natural ecosystem stability and the factors which affect stability. In addition, environmental problems which result from a lack of understanding and application of related concepts are illustrated and discussed.

Slide Script:

1. The survival of the planet depends upon there being enough natural areas.

2. Man, as we all know, is ultimately dependent upon nature for survival.

3. He uses it to furnish every physical want and need.

4. He is an integral part of nature.

5. But what is nature really like?

6. Nature appears placid and serene.

7. A place to get away and enjoy quiet and solitude.

8. But, underneath this is the slow and inexorable movement to change and to become different from what it is now.

9. Nature, the complex grouping of land, air, water, plants, animals and energy, is constantly on the move.

10. It is proceeding toward stability.

11. Whenever disturbed by natural or man-made forces it immediately begins to repair itself.

12. Stability can be described as the state of a natural area where the energy of the sun is being captured at an optimum, an area where the organisms (plants and animals) fit well with their environment and the environment to the organisms.

13. This area is not stable.

14. This area is more stable.

15. The condition of reaching that best point considering all the environmental factors is called the climax stage of succession.

16. It is to everyone's benefit to have a variety of types of natural areas around since, for example, deer in Maine do not prefer to live in a climax forest but rather in a natural area struggling to reach that optimum state.

17. Once it gets there, the deer leave due to lack of browse and shelter.

18. The fact that there are any deer at all around is testimony to one certain thing - changes, both natural (Lightning, fires, wind storms, floods, etc.) and man-made (woodlot clearing, farm land clearing, lumbering, etc.), have occurred in the past and will occur in the future.

19. It is impossible to preserve anything as it is - even nature does not allow this to happen.

20. Sooner or later, even the largest of climax forests, prairies, or shrub land will probably be destroyed by natural causes and a new process toward stability will begin.

21. This process can also be described as a moving from a fragile state toward a state highly resistant to anything other than natural change processes.

22. For example, it would be much easier for man to destroy this area than it would be to:

23. Destroy this area.

24. This is because the process of increasing stability means the increasing in amount and in the complexity of what is present.

25. It is often possible to indicate how stable an area is presumed to be by looking at tell-tale factors. Some of the more common indicators follow:

26. DIVERSITY OF SPECIES - this means that there are a large number of different kinds of species present.

27. This area has a low diversity.

28. This area has a high diversity and is more stable.

29. It is like the difference between a food chain and a food web - a web has more alternatives and is more stable.

30. THE KIND AND AMOUNT OF FOOD AND MATTER PRESENT.

31. As the process of stability proceeds it is important that there be food available for all the organisms and that basic nutrients and minerals be present in the soil.

32. Situations such as this do not enhance normal functioning of the environment.

33. A LARGE NUMBER OF NICHES.

34. A niche is a role that a plant or animal plays. It is his place in the everyday functioning of the natural area.

35. One role or niche would be an insect eater like this.

36. Another niche would be a flower pollinator, and so on.

37. A VARIETY OF HABITATS.

38. There will not be a variety of species or a variety of niches if there is not a variety of habitats. A habitat is the place where an animal lives.

39. This would be a great blue heron habitat.

40. This would be a moose habitat.

41. One area can serve as a habitat for many different species of organisms.

42. A varied terrain with varied habitats will give greater stability to the total general natural environment.

43. THE MAXIMUM CYCLING AND RECYCLING OF MATTER

44. In the natural process, nutrients and materials are used and reused many times in different forms.

45. It is highly beneficial to the stability of a natural system to let the matter which no longer serves any function to be recycled. This prevents the natural area from not growing due to shortage of nutrients.

46. THE EFFICIENT USE OF ENERGY

47. Every day that it shines the sun's light energy is available to the natural environment to be captured by plants and converted to food.

48. This means that there should be a wide variety of plant types and plant levels present to catch the light.

49. It also means that there should be a wide variety of niches so that organisms will have greater opportunity to satisfy their need for energy and will pass this energy on efficiently when they die.

50. A PROPER NUMBER OF INDIVIDUALS PER POPULATION PRESENT

51. Overpopulation of a species in the natural system leads to disastrous results such as:

52. Other species getting crowded out.

53. Certain foods becoming scarce and resulting starvation.

54. Diseases running rampant.

55. Ultimately many of our problems relate directly to species which have become too numerous for their or the natural environment's own good.

56. In the short run, the results of stability on a natural area is good health.

57. In the long run, the results of stability on a natural area is survival.

58. Today, we need people who recognize the need for stability and are sensitive to the need for nature to carry out its natural processes.

59. Examples of what happens when people are ignorant or do not care about a stable environment are all around us. They include: the loss of wetland habitats,

60. the abnormally rapid aging of lakes and ponds,

61. the destruction of animal species, and

62. the wasting of matter,

63. Working for improving natural stability is the responsibility of everyone.

64. THE END.

CORE ACTIVITY NUMBER TWO

Introduction To A Watershed

The purpose of this activity is to introduce to the student the watershed concept. This concept lends itself well to developing broad understandings related to the natural environment and its components. Also, it is increasingly recognized that a watershed perspective provides a sound basis for environmental decision-making.

A. Slide Presentation - Introduction to the Watershed

1. Title Slide

2. (Little Concord Pond - aerial view)

   A watershed by definition is a land area from which water drains to a given point. This is the watershed of Little Concord Stream.

3. (Little Concord Pond - aerial view)

   The boundaries of this watershed are sharply defined by the surrounding mountains.

4. (Little Concord Pond - aerial view)

   The head of this watershed is Little Concord Pond. From it flows Little Concord Stream which makes its way between the two mountains on the lower right.

5. (Aerial view of pond outlet)

   The pond is further characterized by clear water and an undisturbed shoreline. This is where Little Concord Stream begins.

6. (Surface view of the pond)

The pond, itself, could be called oligotrophic. This means it is relatively young, clear, and cold. Brook trout and smelts live here. Eventually, the spring water which feeds this pond, along with some runoff, is exchanged for fresher water as it flows out of the pond and down Little Concord Stream.

7. (View of surrounding mountains from stream)

Little Concord Stream runs through the heavily wooded hills as shown here. The vegetation is mixed hardwood and softwood and uniformly forested. In its slightly less than one mile length, it drops 100 feet.

8. (View of Little Concord Stream and Wetlands)

Below the fall line, where the stream flows over its last waterfall, it meanders through a marsh area. This unique area of the watershed is characterized by a diversity of plant and animal species such as the:

9. (Pitcher plant)

The Pitcher Plant which gains some of the nutrients it needs from insects it captures.

10. (Muskrat)

The muskrat that builds its home and lives near its source of food and cover.

11. (Red-winged blackbird)

The red-winged blackbird that also finds its nesting site and food.

12. (View of Little Concord Stream at its mouth)

Where the Little Concord Stream enters Big Concord Pond the watershed ends. It is at this point that one realizes that one watershed is but a part of another larger watershed which is a part of another, an so on, until the ocean is reached.

13. (Topography and rain)

How big a watershed is and the shape of it depends on the topography or the rise and fall and shape of the land. When water falls on a mountain some of it will flow down one slope and some down another.

14. (Divide)

The point on the mountain where water may go in either direction is called a divide. This is where the water is divided into different directions of flow.

15. (Watershed divides)

The topography or shape of the land of a region determines where the divides are and, therefore, where the watershed boundaries are located.

16. (Topographic lines)

Topography is measured and mapped by topographic lines. A topographic line is a line which follows the contour of the land and all points on that line are at the same elevation. The distance between topographic lines is called the contour interval. This is a distance in height such as 50 feet or 20 feet.

17. (Topographic lines on the watershed model)

Here is a model of the Little Concord Pond watershed area which shows, in three-dimension, the topographic lines.

18. (Watershed boundaries on the watershed model)

This shows how the boundaries of the watershed are determined by the topography or the locations of divides on the landscape.

B. Worksheet Activity - Watershed Boundary

On the topographic worksheet have the students determine the locations and draw the boundaries of the watershed. They may do this while observing slide # 17 above. To provide further assistance, the teacher may draw the boundaries along with the students using an overhead transparency. Since the range of ability of all classes differs, the teacher must decide on how much assistance should be given while still challenging the students.

C. Slide Presentation - Watershed Environmental Decisions

1. (Title slide)

2. (Watershed or stream - aerial view)

Many of our environmental problems today cannot be solved by one town or two. They are common to a watershed. What happens upstream affects the water below. What happens on the land affects the rivers and streams.

3. (Testing water quality)

The quality of the water is an indicator of sound watershed management.

4. (Fish kill)

There are many watershed problems. These include: the introduction of pollutants into streams which have lethal effects on fish.

5. (Turbid stream)

Turbidity of the water and deposits of sediment due to lack of land erosion practices.

6. (Harbor dredging project)

Unsound land management practices contributed to the need to dredge sediment from this harbor.

7. (Aesthetic water quality problems)

Unsightly water problems cause by pollutants.

8. (Nutrient problems caused by shoreline overdevelopment)

Excessive amounts of plant nutrients caused by the overdevelopment of shoreline.

9. (Watershed plan)

To help resolve these kinds of problems, solutions are being developed from the plans for the management of entire watersheds.

10. (Watershed commission meeting)

Watershed commissions and associations are being formed to implement plans and deal with problems.

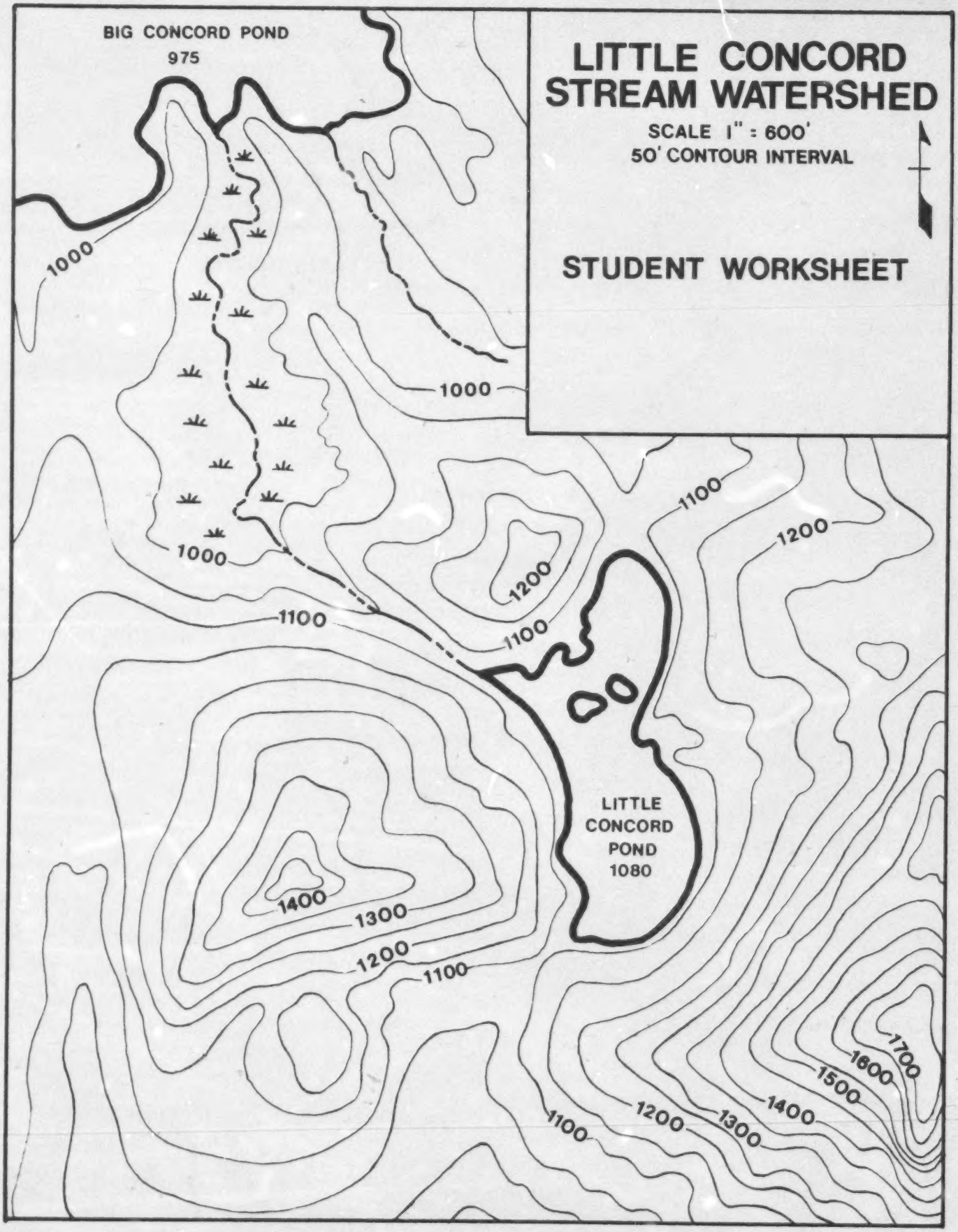
11. (Students monitoring)

Students can also help. These students are assisting their state environmental protection agency by helping gather water quality

data such as dissolved oxygen, bacteria concentration and flow.

12. (Student presentation)

Students can also assist in stimulating community concern for watershed problems by developing and giving thought-provoking public presentations.


BIG CONCORD POND
975
LITTLE CONCORD STREAM WATERSHED
SCALE 1" = 600'
50' CONTOUR INTERVAL
STUDENT WORKSHEET
1000
1000
1000
1100
1100
1100
1200
1200
LITTLE CONCORD POND
1080
1400
1300
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1100
1200
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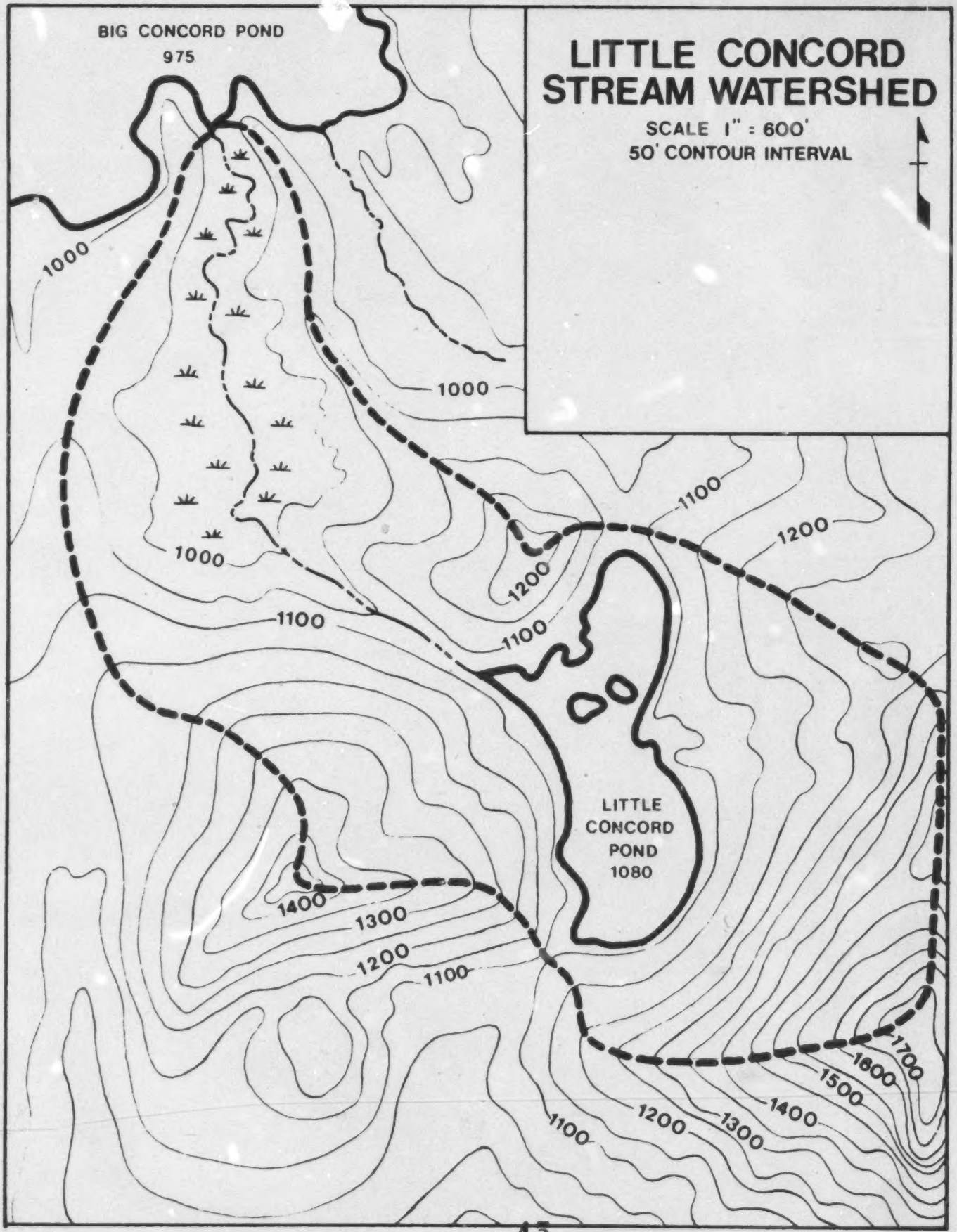
1600
1700


LITTLE CONCORD STREAM WATERSHED
SCALE 1" = 600'
50' CONTOUR INTERVAL
BIG CONCORD POND
975
LITTLE CONCORD POND
1080
1000
1100
1200
1300
1400
1500
1600
1700

CORE ACTIVITY NUMBER THREE

Watershed Natural Ecosystem Evaluation

The purpose of this activity is:

1. To identify physical environmental factors which have a role in determing the natural stability of a watershed.

2. To identify how various conditions of each factor can increase or decrease stability.

3. To combine these factors and their value ratings to obtain an overall watershed stability evaluation. Through this process the student will be able to visually identify natural areas within the watershed which are the most sensitive and least sensitive to change.

A. TRANSPARENCY PRESENTATION -

Overview of the Little Concord Stream Watershed

There are six different communities in the Little Concord Stream Watershed. A community is made up of plant and animal populations in a distinct area or habitat. These may be introduced to the students with a transparency and a brief description of each.

1) Little Concord Pond is a 26 acre lake with a maximum depth of 56 feet. It is clear and cold. The primary food chain is plankton (small plants and animals), minnows, smelts, brook trout and pickerel. Since it is a young lake the bottom is gravel with little sedimentation. There is yet little indication of its slow change to becoming a bog.

2) Little Concord Stream flows out of the lake and into Big Concord Pond. It is quite small. It is young and fast flowing where it leaves the pond, but slows down and meanders when it reaches the fresh water bog. The cooler waters are near the lake and they become warmer in the bog. Oxygen content is fairly high, particularly at the end of its drop to the bog. It is suitable habitat for trout in the upper reaches and chubs and suckers in the lower.

3) The Fresh Water Bog is a low wet area of approximately 40 acres in size. The water is warmer and it is flooded annually. It has a high variety of different kinds of plants and animals. Plants include cattails, rushes, grasses, sedges, pitcher plants, skunk cabbage, buttercups, tamarack and alders. Animal species include muskrat, mink, red-wing blackbird, moose, deer, great blue heron, bittern, raccoon, and tree swallows. It is a gathering place for many species of wildlife.

4) The Aspen-Birch community surrounds the bog. These trees have shallow roots and large water requirements making this area with the higher water table an ideal location for them. This area represents a latter stage of succession than the fresh water bog.

5) The Mixed Hardwood community covers a large portion of the watershed. It contains mature trees and is quite densely wooded. Species include maple, beech, and birch as well as some scattered white pine and hemlock. It contains the animal species of the many upland hardwood forests. These include ruffed grouse, white-tailed deer, porcupine and chickadees.

6) The Spruce Fir communities are located toward the tops of the mountains. Both the climate and the soil conditions here favor this type forest. The many rocky outcrops and ledges also favor those plants common to early successional stages. These include lichens, mosses and pioneer grasses. Animal populations are less numerous here.

B. TRANSPARENCY PRESENTATION -

Rating Factors for Watershed Stability

The state of the following seven factors contributes to determining the stability of a natural ecosystem. These factors are:

Slope, soil depth to bedrock, erodibility, soil fertility, ground cover, species diversity, and the stage of succession.

In nature, each factor occurs in a variety of conditions which enable it to contribute toward a high, medium, or low stability. Each factor can be evaluated and the values for all factors combine to give a composite picture of stability in the watershed. These can be visually presented with overlays.

This activity is designed to have the teacher present each factor to the students and to discuss how it may be rated as to its role in stability.

The recommended teaching sequence and basic teaching content follows:

1) Slope

Slope is the amount of rise or fall of the land for a given distance. It is usually expressed as a percentage. For example, for a 10% slope there is a 10 foot rise or fall over a 100 foot distance horizontally. Sometimes slope is expressed in degrees which refers to the angle made by the horizontal plane and the incline plane or rise. For example, a 45° angle slope is ½ way between a straight up and down cliff and perfectly flat land.

On the overlay - anything over 25% slope which is a 25 foot rise over a 100 foot run (coded dark) is considered to be most unstable and very sensitive to change. A 15-25% slope (coded light grey) is considered to be less sensitive to change but more sensitive than those slopes which are between 0-15% (coded white).

Discussion Questions:

1. Why is a steep slope more sensitive to change?
2. Why is the 0-15% slope considered to be less sensitive to change?
3. What natural factors would make a steep slope less sensitive to change?

2) Soil Depth to Bedrock

The depth of the soil to bedrock can also affect the stability of a natural ecosystem. This simply means how deep the soil in the weathered rock material is. This material provides the basis for plant and animal life. Therefore, the amount available is very important. Ten inches or less of soil to bedrock would be considered very shallow and this condition is more vulnerable to change. It is also very likely a younger soil. On the overlay it is coded dark. Up to 40" in depth to bedrock could be considered a medium depth (coded light grey). This soil is more plentiful and is conducive to a greater abundance of life. Over 40" of soil to bedrock would be considered deep. As far as amount is concerned, it promotes the greatest abundance of life. It is coded white.

Discussion Questions:

1. What are some of the reasons why shallow soil is less likely to contribute to stability?

2. On what type of terrain would you expect to find shallow soil?

3. What forces would cause deeper soils?

3) Erodibility

Erodibility is the soil's susceptibility to being removed from one place to another. It is based on the inter-relationship of several factors among which are soil texture and slope. A high erodibility rating (coded dark) indicates that soil is easily lost because the texture is fine and the slope is steep. A medium erodibility rating (coded light grey) indicates a soil that is coarser and/or on a less steep slope. A low erodibility rating indicates a situation where the soil is least likely to be lost and reflects coarse soil texture and/or little slope.

The coarser soils are more permeable to water and, therefore, less subject to the run-off which creates erosion. This would give a low erodibility (coded white) if the slope is not great. It should be noted that fine textured soils could be given a low erodibility rating if there were no slope.

Discussion Questions:

1. What other factors besides those above do you think would affect the erodibility rating?

2. Why is erodibility an important factor to consider in natural ecosystem stability?

3. How would a lot of living organisms affect erodibility?

4. What determines the texture of soil?

4) Soil Fertility.

Soil fertility refers to the availability of nutrients for the primary producers (plants). Major nutrients in the soil include potassium, phosphates, and nitrogen. It is the pH or acidity of the soil which determines how available the nutrients which are present will be for plant consumption. If a soil is too acidic (low pH) or too alkaline (high pH) it will lock up the nutrients for most plants. The majority of plants prefer a pH which is slightly more alkaline than it is acidic. This soil is considered to be of high fertility and is coded white. A soil which is slightly more acidic or alkaline is considered to have medium fertility and is coded light grey. A soil which is highly acidic or alkaline and which also may have nutrients missing is considered to be of low fertility and is coded dark.

Discussion Questions:

1. How does high soil fertility lead to a greater stability in the natural ecosystem?

2. Why would some areas have higher fertility than others?

3. How can one tell soil fertility by looking over the landscape?

5) Ground Cover

Ground cover refers to the amount of surface area which is covered with vegetation. It gives an indication of how efficient an area is in capturing the sun's energy. Included in the concept is the density of vegetation and the number of levels of light capturing leaves. The greater the density, the higher the number of levels, and the greater the surface area covered, the higher will be the rating of stability for that location (coded white).

A medium rating (light grey) would result from less dense vegetation, fewer levels with light capturing leaves, and a lesser surface area covered. Those areas coded dark have less ability to capture the sun's energy when compared to the others.

Discussion Questions:

1. What other benefits result from a high percentage of ground cover?
2. What factors contribute to differences in ground cover?
3. What would you look for when determining the ground cover rating?

6) Species Diversity

Species diversity relates to the number of different kinds of plants and animals found in a given area. A highly diverse area would contain many different species of plants, therefore, animals. An area with high species diversity (coded white) is more likely to be stable because its richness of species allows one to be eliminated without removing them all. For example, a field containing one type of grain can be a place where there is a variety of animal life. Should all the grain be at attacked by a certain type of beetle and die, all other species must find another area or themselves, die. Diversity allows alternatives and keeps the pressure off any one species. An area coded light grey contains fewer species although it may contain the same number of individuals. An area coded dark would contain fewer species still and may have several populationsor even one population (like the corn field) predominate.

Discussion Questions:

1. What does the Dutch Elm Disease problem tell us about diversity?

2. What might cause diversity to drop?

3. What is the effect of the diversity of plants on the diversity of animals?

7) Populations

Population refers to the number of individuals in each species. For any given place and situation there is an optimum number of individuals for each species population. This optimum population number represents a species which is contributing to the total health of the ecosystem through its role in the food web. This results in efficient use of energy and cycling of matter. If a population of a species has too few individuals, the species will not reproduce itself and will die out. On the other hand, if a population of a species has too many individuals, or an overpopulation, this may lead to:

1. other species being crowded out,

2. certain foods becoming scarce,

3. disease running rampant, and

4. niches and habitats disappearing.

On the overlay, areas within the watershed having optimum population conditions are coded white. Areas with less desirable population conditions are coded light grey and areas with undesirable population conditions are coded dark.

Discussion Questions:

1. What could happen when one species becomes too numerous for an area?

2. What could cause over population?

3. What could cause underpopulation?

C. TRANSPARENCY PRESENTATION -

Combining the Factors for Watershed Stability Analysis

Following the analysis of each stability factor the seven overlays should be placed over each other to obtain an overall picture of stability in the watershed. Those areas which are darkest are the least stable and, therefore, the most sensitive to change. Those areas which are lightest are the most stable or most resistant to change.

Discussion Questions:

1. According to the overlays, where would be the place to put your cabin that would have the least detrimental impact on the watershed?

   How would you go about determining the best location? What steps would you go through?**

2. If you had to design a road to cross the watershed, where would it go?

3. If you were zoning this watershed according to the three categories of "no development," "limited development" and "general development," where would each of these zones be?

** Note to the teacher: The discussion of these questions should provide the basis for reviewing the following problem-solving steps:

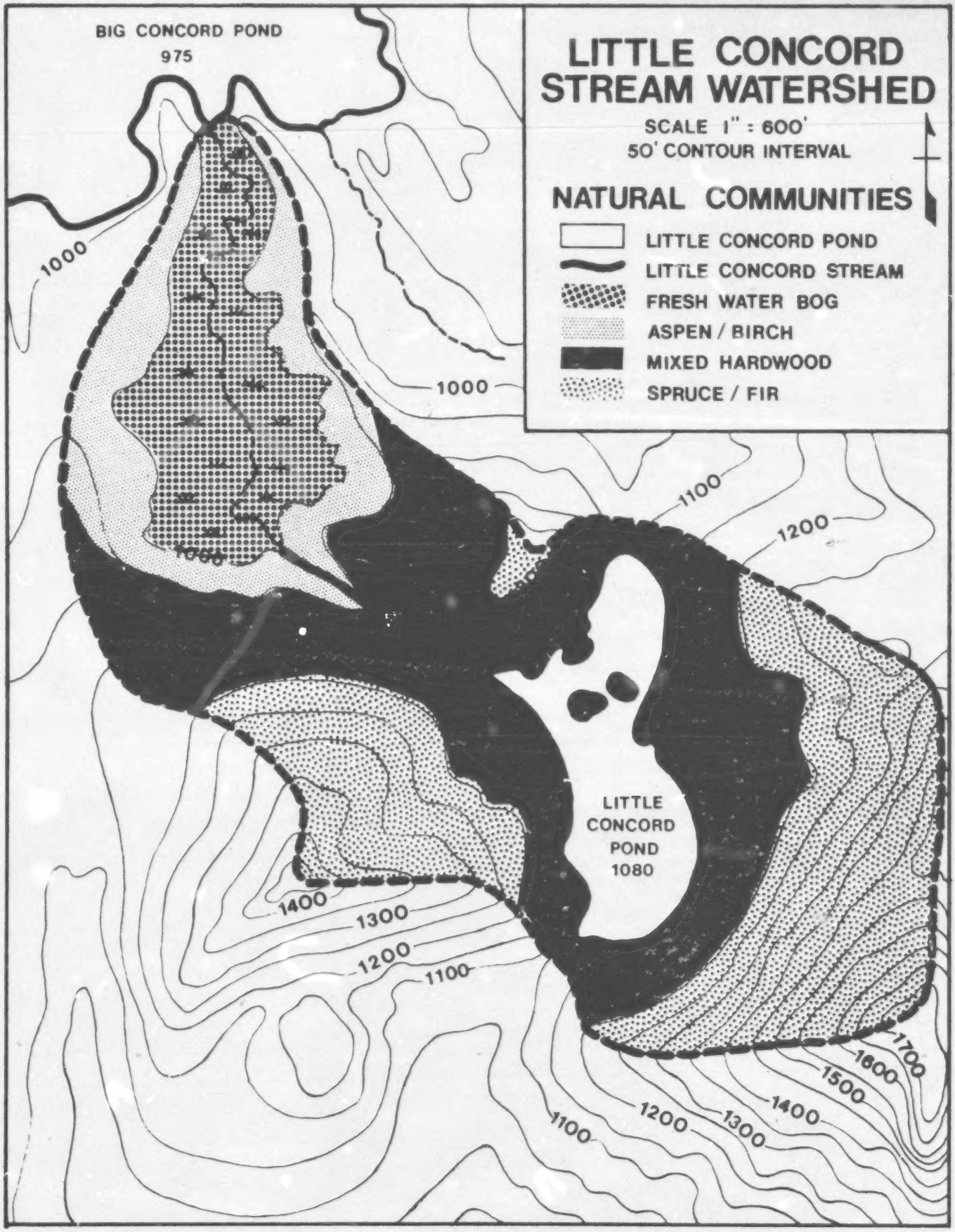
1) Determine what natural environmental features are most desirable for locating a cabin.

2) Find out what effect a cabin would have on the natural features.

3) Determine the location of potential sites and their natural characteristics or features.

4) Compare the known effects of a cabin with the characteristics of potential sites and select the site which would be the least damaged by the cabin.

5) Call in experts to check your decision on a location.


BIG CONCORD POND
975
LITTLE CONCORD STREAM WATERSHED
SCALE 1" = 600'
50' CONTOUR INTERVAL
NATURAL COMMUNITIES
LITTLE CONCORD POND
LITTLE CONCORD STREAM
FRESH WATER BOG
ASPEN / BIRCH
MIXED HARDWOOD
SPRUCE / FIR
1000
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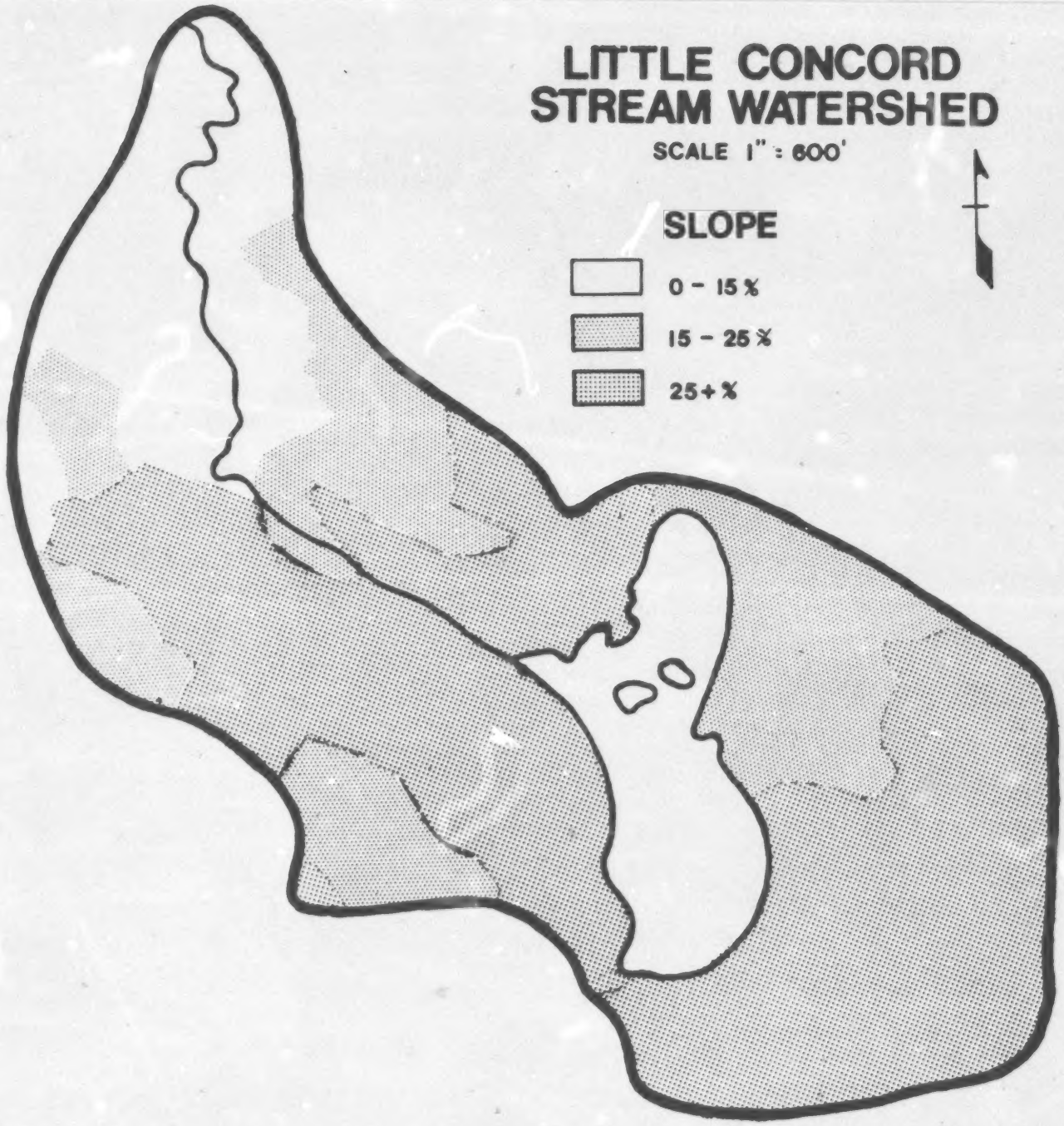
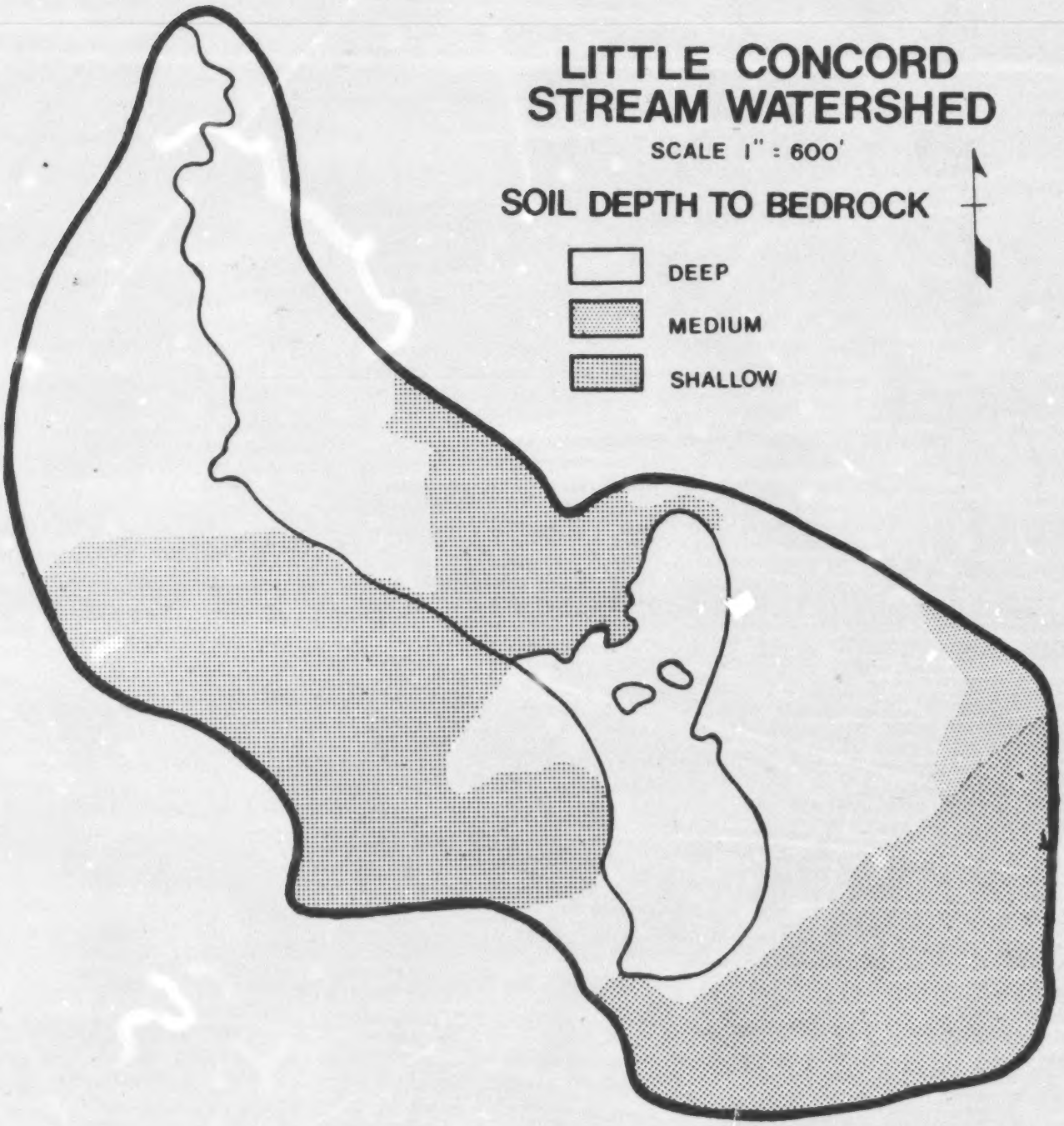
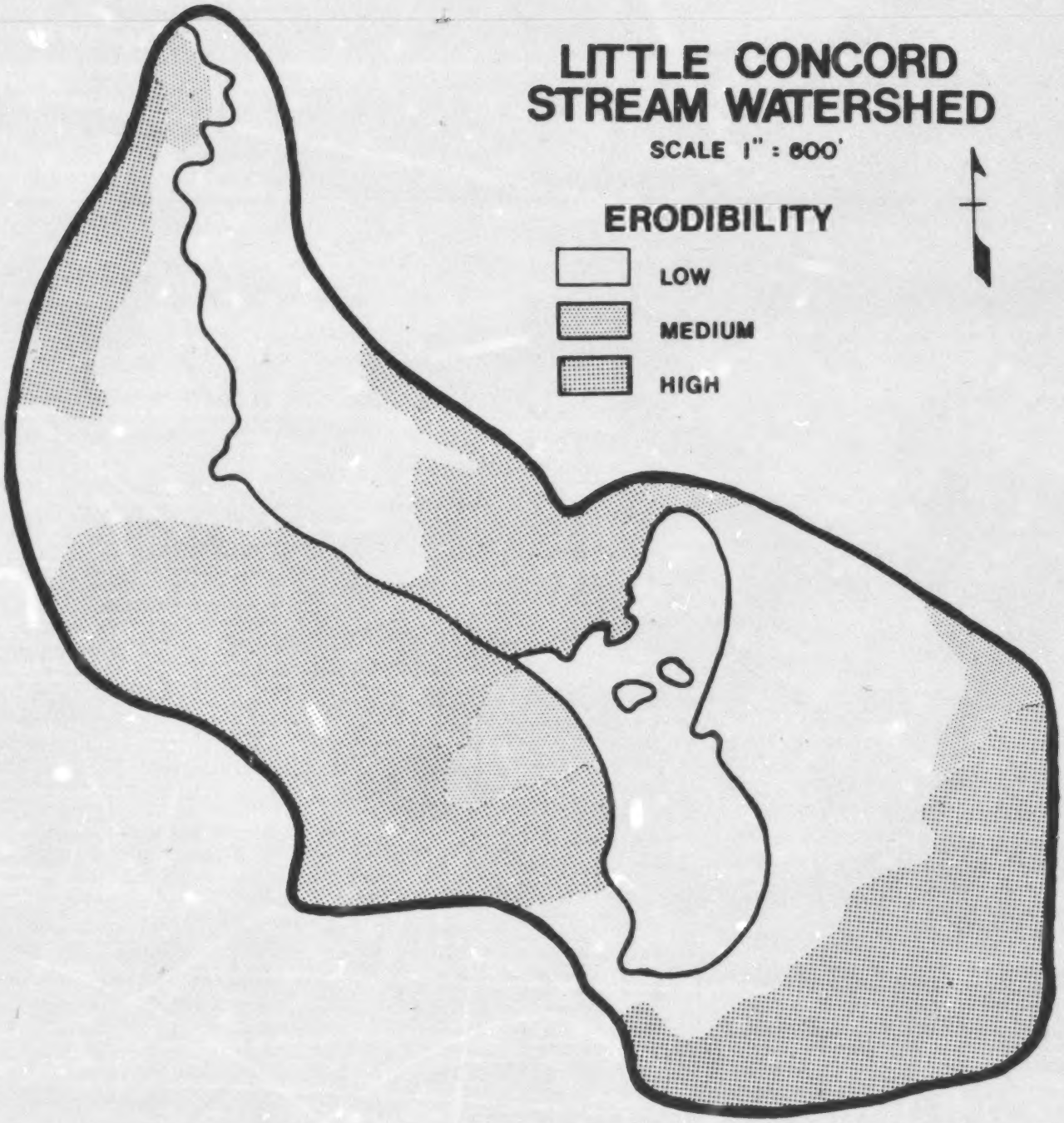

LITTLE CONCORD
STREAM WATERSHED
SCALE 1" = 600'
SLOPE
0 - 15 %
15 - 25 %
25+ %


LITTLE CONCORD
STREAM WATERSHED
SCALE 1" : 600'
SOIL DEPTH TO BEDROCK
DEEP
MEDIUM
SHALLOW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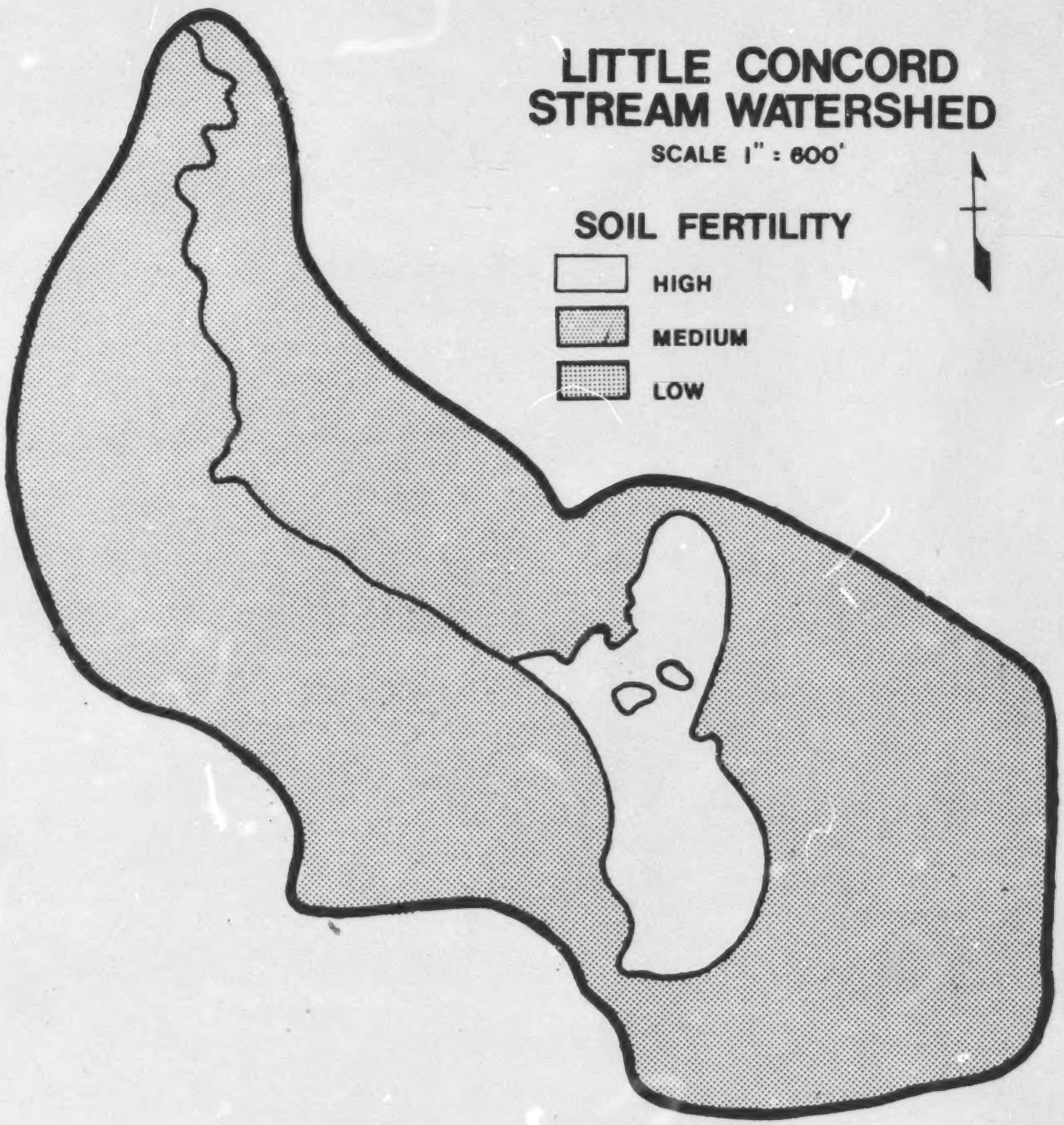
STREAM WATERSHED
SCALE 1" : 600'
ERODIBILITY
LOW
MEDIUM
HIGH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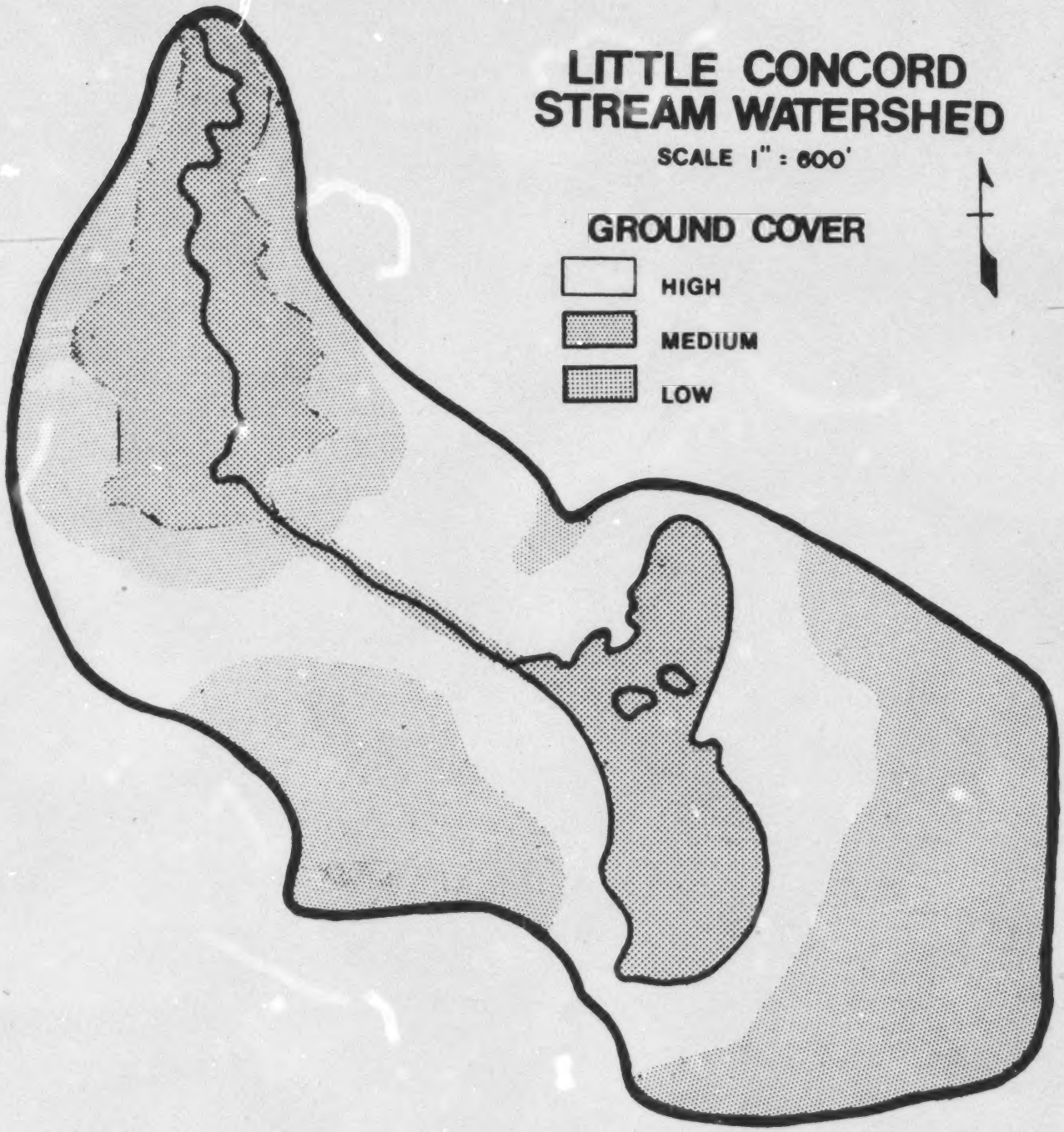
STREAM WATERSHED
SCALE 1" = 600'
SOIL FERTILITY
HIGH
MEDIUM
LOW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STREAM WATERSHED
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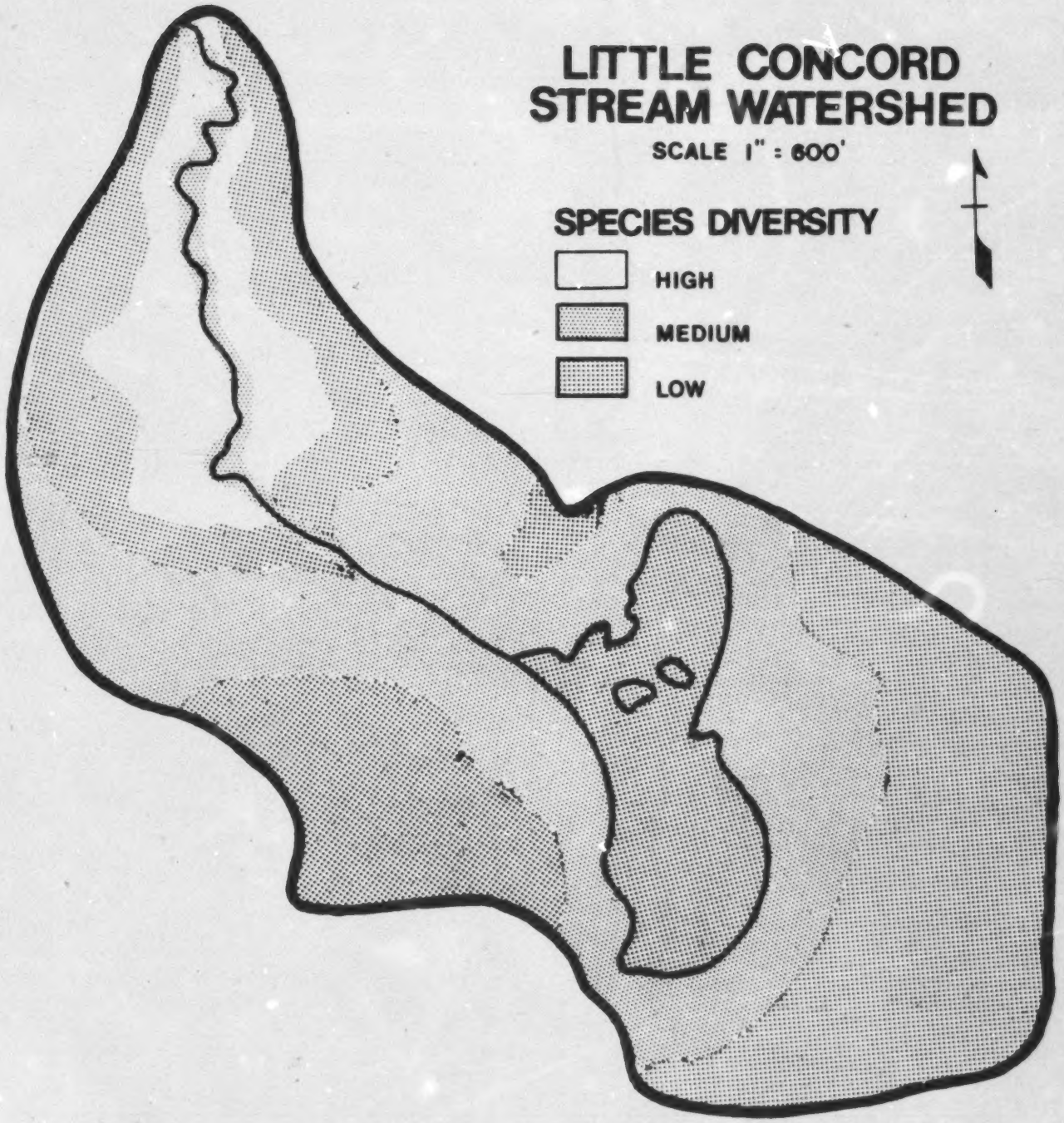
GROUND COVER
HIGH
MEDIUM
LOW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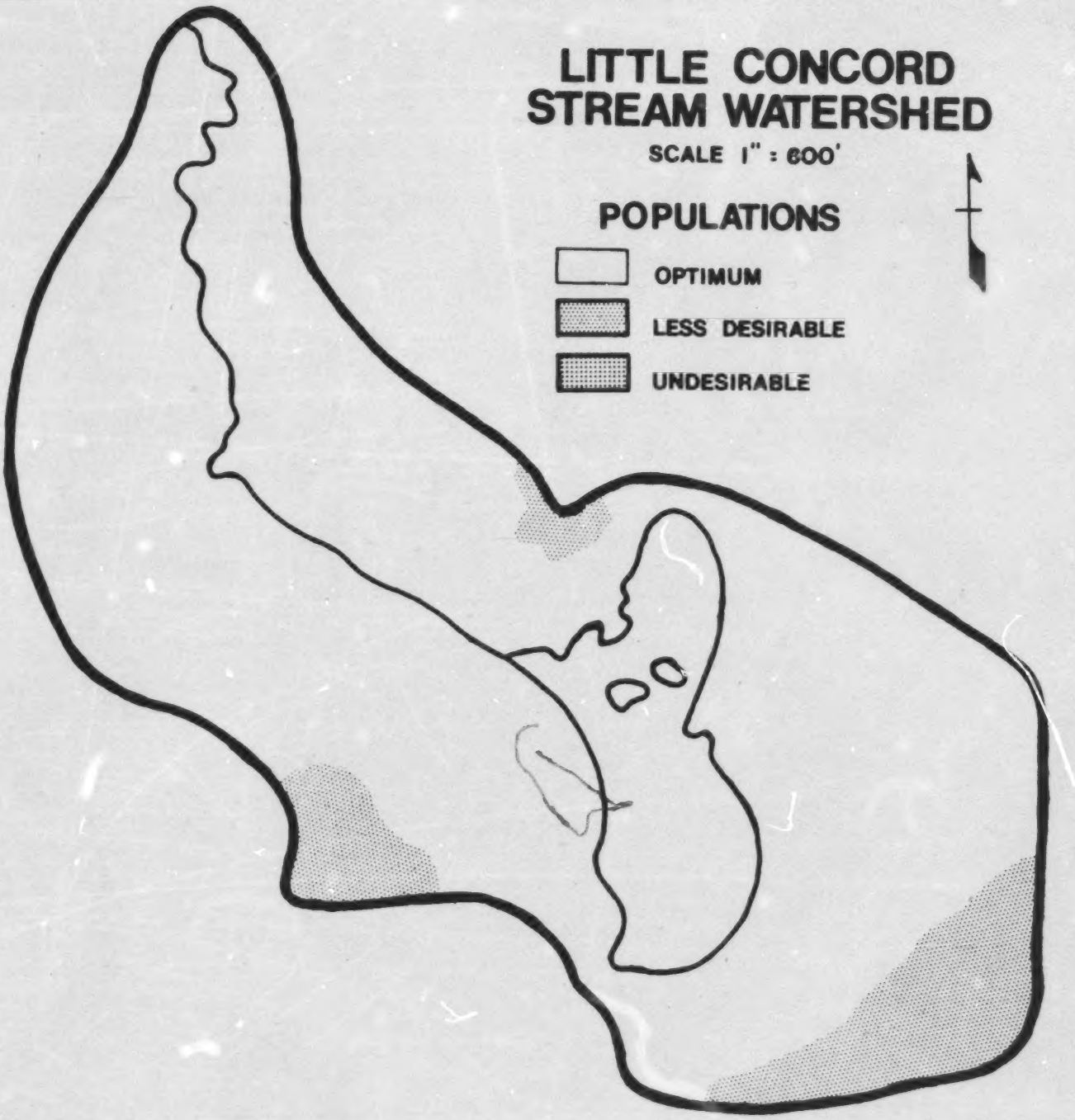
SPECIES DIVERSITY
HIGH
MEDIUM
LOW


LITTLE CONCORD
STREAM WATERSHED
SCALE 1" : 600'
POPULATIONS
OPTIMUM
LESS DESIRABLE
UNDESIRABLE

NATURAL ECOSYSTEM FIELD EVALUATION

The purpose of this activity is to involve the student in a field experience during which he must rate different attributes of different plots of land. By looking at and evaluating a series of factors which contribute to stability it is possible to arrive at a rating number. This number, compared to the number of the other plots, will give the students an indication of the relative stability of each plot. This exercise provides a basis for identifying stability factors and in-field evaluations of natural stability.

Field Experience

Step 1: Stake out four, one meter square plots on the site. It is suggested that these plots are varied in the following way:

PLOT # 1 - no topsoil, sand or gravel soil with one (1) plant

PLOT # 2 - some topsoil, scattered plants of approximately two (2) species

PLOT # 3 - thin topsoil, small variety of plants

PLOT # 4 - rich, deep topsoil, good variety of plants, may include small trees

Step 2: Divide the class into four groups. Assign each group to a plot. Give each group a field evaluation sheet. Explain to each group that it will work together to arrive at group concensus ratings for each of the seven questions. Go over the evaluation sheet with the students. Rotate until all four groups have rated all four plots.

Step 3: Each group should total and average the numbers for each plot. All groups report to the class its averages. These will be recorded on separate overhead transparency graphs. For comparison, lay all transparencies over each other on the overhead projector.

Step 4: Discussion Questions:

1. How would you describe the changes in the plots as the curve rises?

2. What does it mean when the line curve rises?

3. Why is plot number four more stable than plot number one?*

* It should have become apparent to the student by this time that a higher rating number indicates greater stability.

NATURAL ECOSYSTEM FIELD EVALUATION

While observing the plots which have been marked off, answer each of the following questions by selecting a rating number. Each rating should be agreed upon by the group. Place the rating number for each plot in the space at the right of the question. Total and average all ratings for each plot.

1. How would you rate the number of different species of producer organisms (plants) present? (approximately)

   1=(1-3) plants 4=(10-12) plants
   2=(4-6) plants 5=(13+) plants
   3=(7-9) plants

2. How would you rate the presence of consumers (animals) and also, how likely they are to be here?

   1 2 3 4 5
   none very high

3. How would you rate the evidence which indicates the presence of decomposer-transformer (bacteria, etc.) organisms?

   1 2 3 4 5
   none very high

4. How would you rate the balance of populations of species?

   1 2 3 4 5
   one species population dominates — no one species population dominates

5. How would you rate the amount of non-living materials <u>available</u> for use by all species?

   1 2 3 4 5
   little much

6. How would you rate the amount of the sun's energy being used by the organisms in the plot?

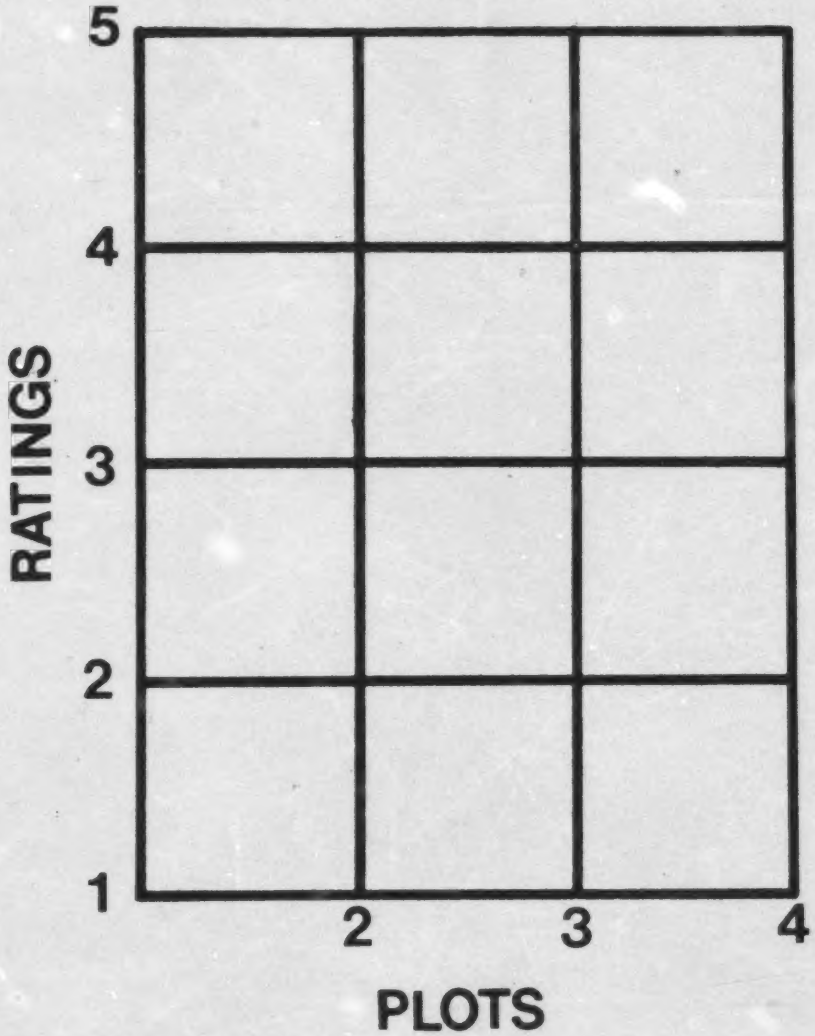
   1 2 3 4 5
   little much

7. How would you rate the ability of the plot to efficiently use and re-use the carbon dioxide you are exhaling, rain, and available mineral nutrients in the soil?

   1 2 3 4 5
   little much

PLOT NUMBERS			
1	2	3	4
TOTALS			
AVERAGES			

NATURAL ECOSYSTEM FIELD EVALUATION DATA GRAPH



CORE ACTIVITY NUMBER FIVE

A FIELD EXERCISE

The purpose of this activity is to provide an opportunity for students to apply their grasp of natural ecosystem stability concepts to two community natural areas. In addition to first-hand field investigations, students are asked to consider related social, political and economic aspects.

Field Trip in Community

Identify two (2) different natural sites in the community to be visited on a field trip. Divide into five teams:

1. SLOPE TEAM
2. FERTILITY TEAM
3. GROUND COVER TEAM
4. DIVERSITY TEAM
5. STAGE OF SUCCESSION TEAM

and have each team, after investigation, rate its factor on the site. Decide whether it possesses high, medium or low overall qualities. Since this is a comparative study between two sites, the results will be relative in nature. After each team reports its findings, along with evidence on its investigations on both sites, it should be possible to get a composite rating of relative stability. Several factors involve the use of equipment (e.g., for slope, a clinometer) which already may be present or is easily obtained or made. Other resources such as soils maps, aerial photos and topographic maps may be used to good advantage. Discussion on the meaning of the exercise should follow.

Conclude with a study on related economic/social/political aspects of the two natural areas being investigated. Questions to be answered include:

1. What is the value of the property? Why?
2. Is the value changing? Why?
3. How is the property affected by land use controls (zoning)?
4. If sub-divided, what measures, if any, must be observed by the builder to protect the character of the area?

5. Is there any interest on the part of the town in these areas?

6. What can citizens do if they have decided that these areas should be protected from future development?

SECTION III

PRE - POST TEST

Student Name_____Grade____Date_____

NATURAL STABILITY

Pre-Post Test

Directions: Unless otherwise indicated, check the one best answer for each test question:

1. Stability in nature can be defined as:

_____a) the condition where all natural changes have come to a stop

_____b) the condition where the animal populations are in balance for that climate and area

_____c) the condition where natural and non-living things are inter-acting at top efficiency for the climate and area

_____d) the condition where plants are growing faster; therefore, more animal food is being produced.

2. Which of the following contribute toward making an ecosystem stable? (You may check more than one)

___a. overpopulation
___b. species diversity
___c. mild climate
___d. maximum cycling and recycling of matter
___e. large number of niches
___f. efficient use of energy
___g. large communities
___h. kind and amount of food and matter present
___i. proper number of individuals
___j. complexity of habitats
___k. variety of carnivores
___l. variety of habitats
___m. maximum number of transformers
___n. proper soil type

3. A watershed is:

_____a) a building where water is purified

_____b) any land between two lakes

_____c) a land area from which water drains to a given point

_____d) the largest unit of measurement for stream size

_____e) none of these

4. A divide is:

_____a) a point of land where water may flow more than one way

_____b) exactly one-half the distance between lakes and rivers

_____c) greater than a watershed but less than a region

_____d) a direct line from one body of water to another

_____e) none of these

5. Topographic lines:

_____a) join the highest points of a watershed

_____b) show land which is at the same elevation as other land

_____c) show water depth

_____d) show land which has the same type of soil as other land

_____e) none of these

6. Which of the following would you consider to be desirable characteristics of the location where you are planning to build a house? You may check more than one.

_____a) large numbers of one kind of plant

_____b) large numbers of different species

_____c) low ground cover

_____d) low soil pH

_____e) low erodibility

_____f) deep soil to bedrock

_____g) 0 - 15% slope of the land

7. Which of the following would have the highest stability rating?

_____a) a meadow

_____b) a gravel road

_____c) a woodland

_____d) a shallow lake

8. Consider the watershed below. Each number represents a site which is described on the right side of the drawing. Check the site which would be the best place to build a lumber mill.

Site 1:

- on the river
- steep slopes
- easy access
- inexpensive to build
- shallow soil to bedrock
- few trees

Site 2:

- expensive to get at
- expensive to build
- heavily wooded
- deep soil to bedrock
- flat land
- away from stream

Site 3:

- steep slopes
- close to road
- sparsely wooded
- fertile soil
- shallow soil to bedrock
- close to stream

9. In order to solve the problem of where to place the lumber mill, select the <u>first five most important</u> steps and number them in the order in which they should be carried out.

1 = most important
2 = next in importance, etc.

_____Find out what effect a lumber mill has on the natural features

_____Find out how much the lumber mill will cost to construct

_____Determine the location of potential sites and their natural features or characteristics

_____Find out how long it will take to build the mill

_____Call in experts to check your decision on a location

_____Find out how much electricity it will take to run the mill

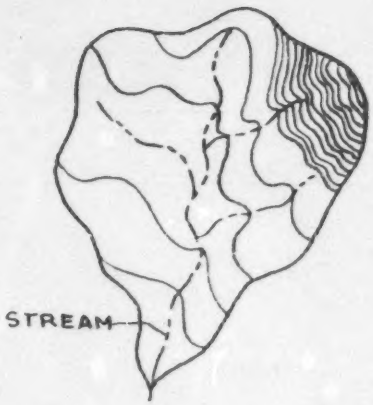
_____Compare known effects of lumber mills with existing features of sites and select the site which would be the least damaged by the mill

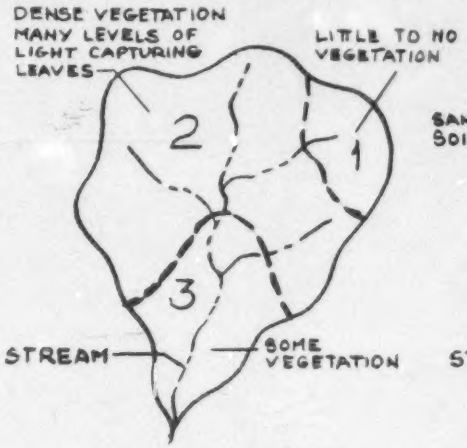
_____Determine what natural environmental features are most desirable for locating a lumber mill

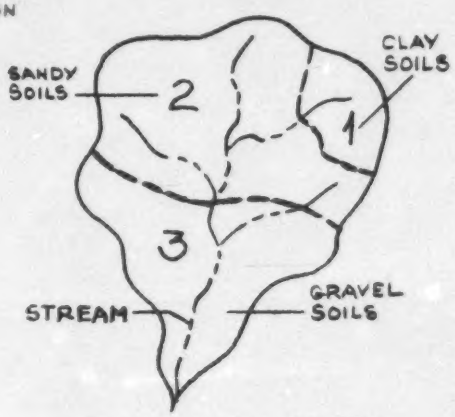
10. On the left are stability factors. On the right are more specific characteristics of these and other factors. Match the columns. There are more characteristics than factors. Select the best characteristic for each.

_____Slope	a. number of individuals per specie
_____Depth to bedrock	b. pH
_____Erodibility	c. variety of plants and animals
_____Soil fertility	d. 25+ %
_____Ground cover	e. vegetation density
_____Species diversity / _____Populations	f. soil texture and slope
	g. outcrop
	h. compost
	i. 50°
	j. high water table

11. Below are three maps of the same watershed. Each map represents a major characteristic or natural condition that contributes to stability or health of an area.







SLOPE MAP

20' contours
Scale $\frac{1}{2}$" = 1000 ft.

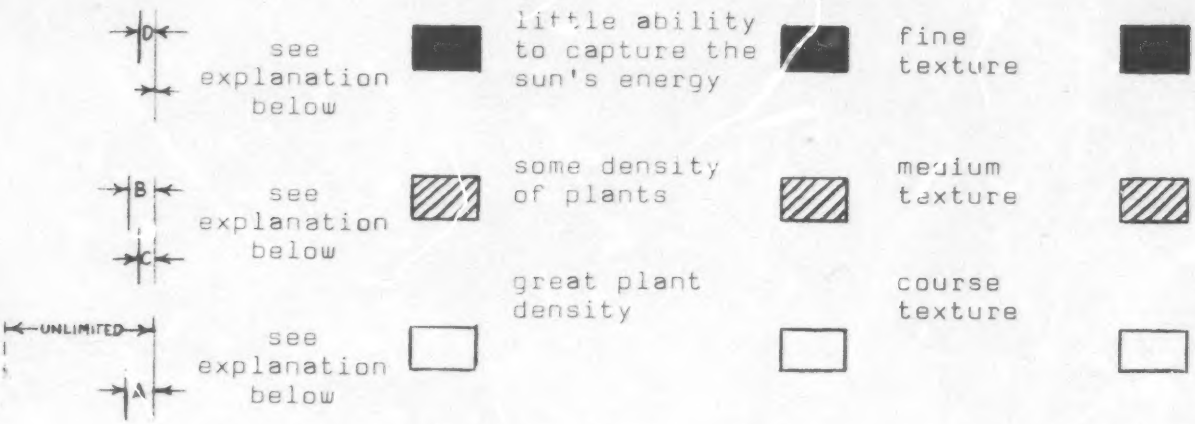
Directions: With a pencil, code the watershed map above with the 3 slope symbols below according to the distance between contour lines.

GROUND COVER MAP

Directions: With a pencil, code the 3 numbered areas shown by the dotted line. Use the symbols below which show the amount of ground cover.

SOIL TEXTURE MAP

Directions: With a pencil, code the 3 numbered areas shown by the dotted line. Use the symbols below which show the soil texture.



For a greater than 25% slope the distance between contours will be not wider than D to no space between contour lines.

For a 15-25% slope the distance between contour lines would be not wider than B and not narrower than C.

For a 0-15% slope the distance between contour lines would be from an unlimited distance to not narrower than distance A.

11. Continued -

Is there an area in the watershed which might be unstable, that is, an area which could change in a way which would be bad for the plants and animals that live there.

_____ YES _____ NO _____ UNDECIDED

If there is a potential problem, check from the list below what it might be.

_____Flooding

_____Erosion - loss of matter

_____Lack of Water

_____Air quality

Looking at the soil texture map on the previous page, which of the numbered areas would be the problem area. (Circle the correct number).

1 2 3